

ENVIRONMENTAL FOOTPRINT WORK GROUP –

Agenda for May 28, 2008

1. Welcome & Introductions

2. Overview

Energy plan process

Overall objectives

Work group process

3. Background information review

Energy use/fuel mix (DE vs. US)

Emissions/pollutants

Current regulations/strategies

4. Informational Questions

What environmental pollutants should we assess?

What are the main contributors to Delaware's high energy consumption per capita?

How do Delaware's energy and environmental regulations compare to those of neighboring states?

What are the energy impacts of other (environmental) regulations?

5. Objectives for the 'Environmental Footprint' Work Group

Key Questions to be Addressed

Identify Major Issues

Formulate Recommendations

6. Develop activities/game plan for the work group

Path forward and assignments

Meeting logistics

Timeline

7. Next meeting date, time, place, key agenda items

A Few Energy Facts

World Energy Consumption \approx 400 Quads/yr

US Energy Consumption \approx 100 Quads/yr

Delaware Energy Consumption \approx 0.3 Quads/yr

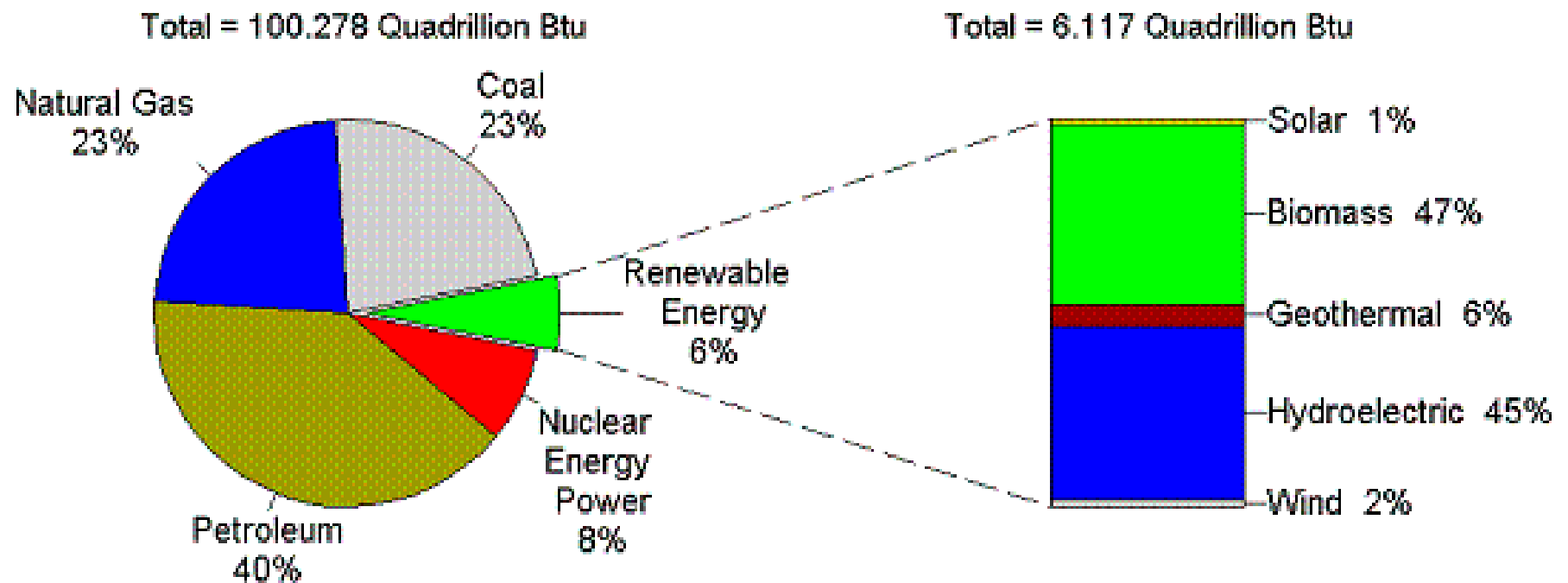
(Quad = Quadrillion BTU)

US *daily* consumption: 20 million barrels of oil

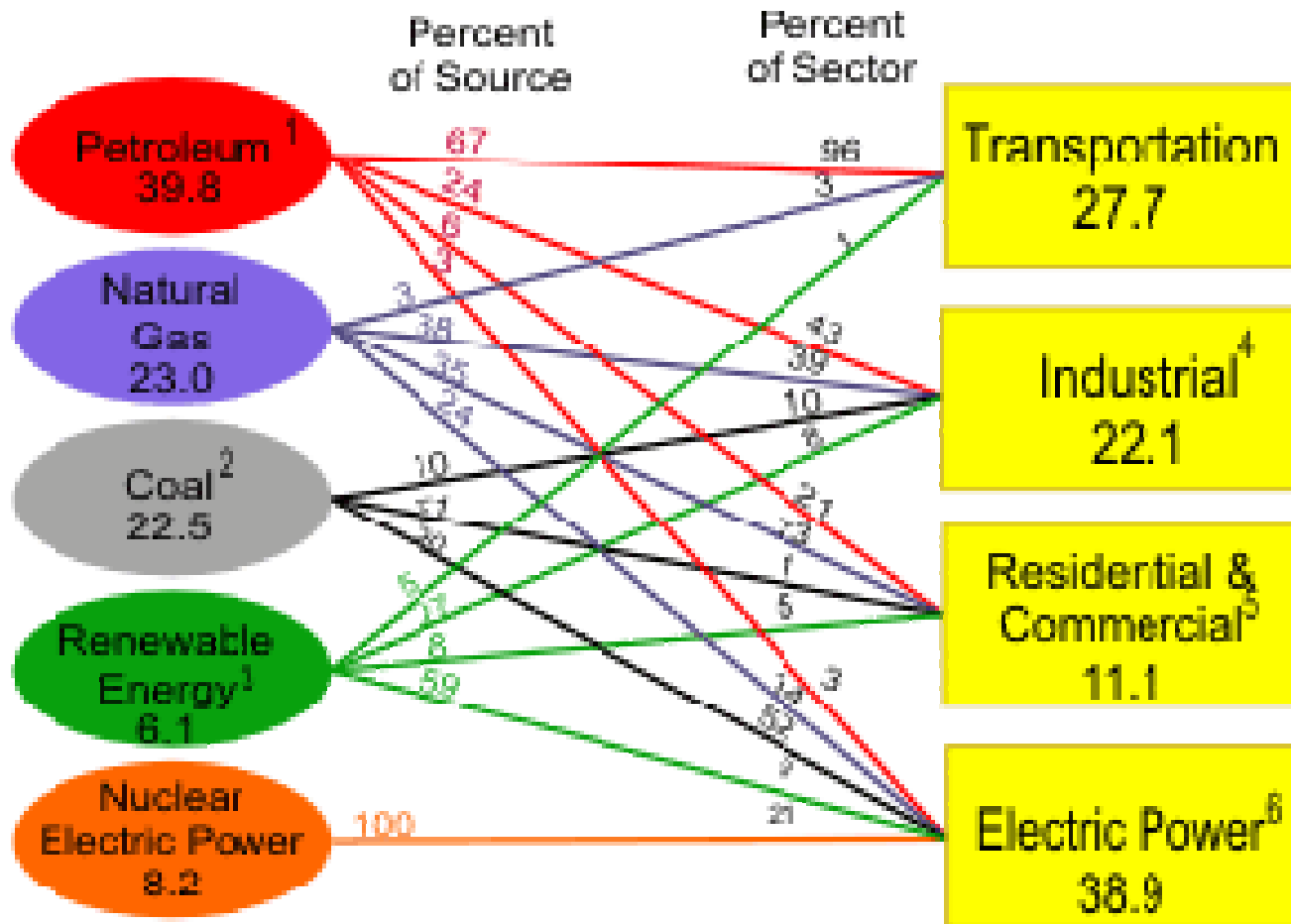
60 billion cubic feet of natural gas

3 million tons of coal

Total US Energy Consumption (2004)



US Energy Sources and Uses



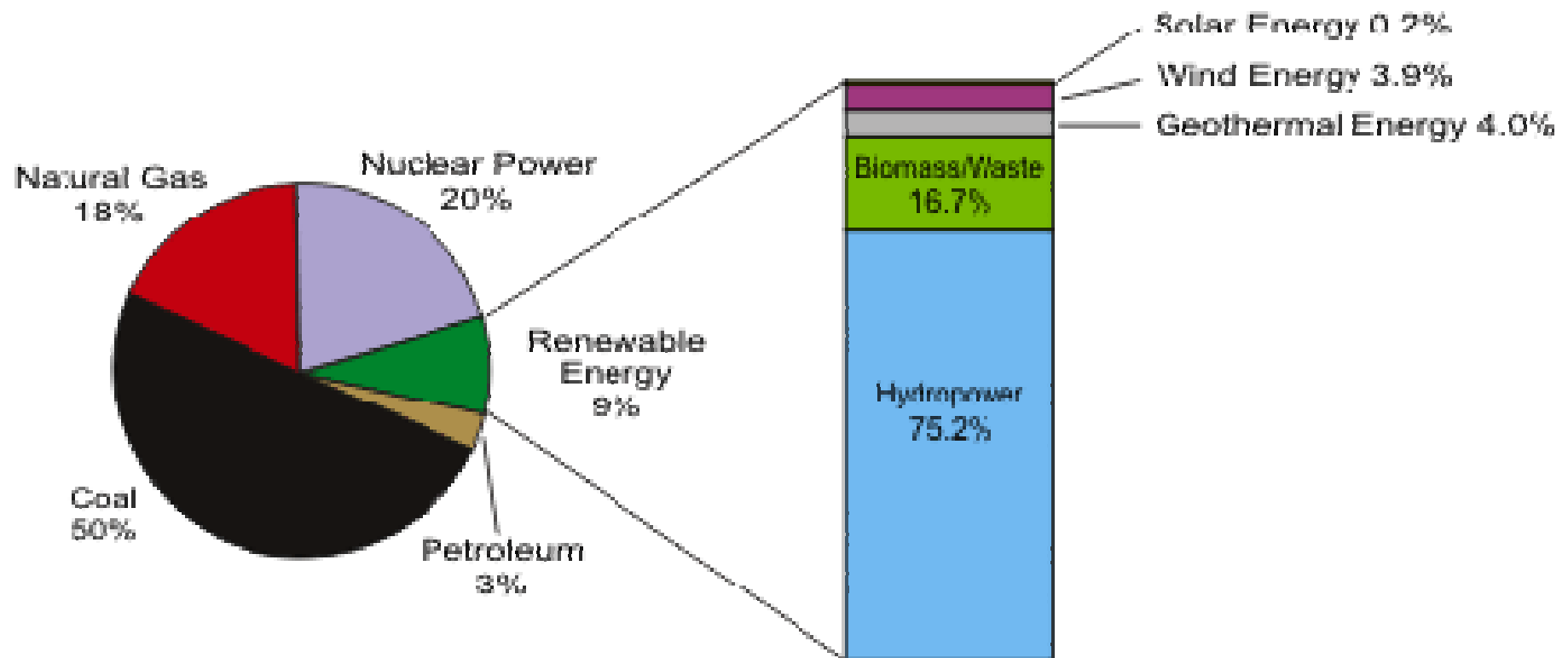
U.S. Primary Energy Consumption by Source and Sector, 2004 (quadrillion Btu)

Source: <http://www.eia.doe.gov/basics/energybasics101.html>

Energy Sources for US Electricity

Total U.S. Generation = 3,953
(billion kilowatthours)

Total Renewable = 359
(billion kilowatthours)



US Energy Mix

Electricity Generation (~40% of total):

50% Coal, 20% Nuclear, 18% Natural gas,
3% Petroleum

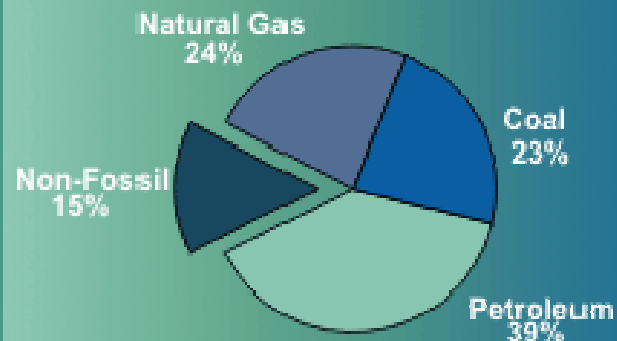
Transportation Fuels (~30 % of total):

96% Petroleum

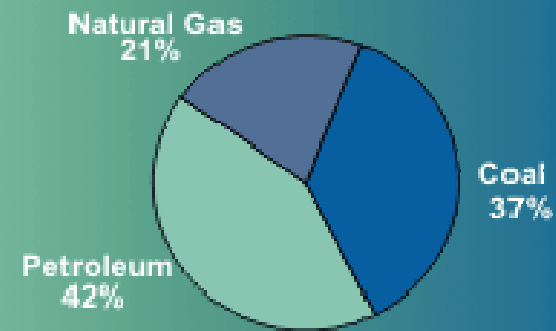
Very little overlap between energy sources for these two dominant sectors!

U. S. Primary Energy Consumption

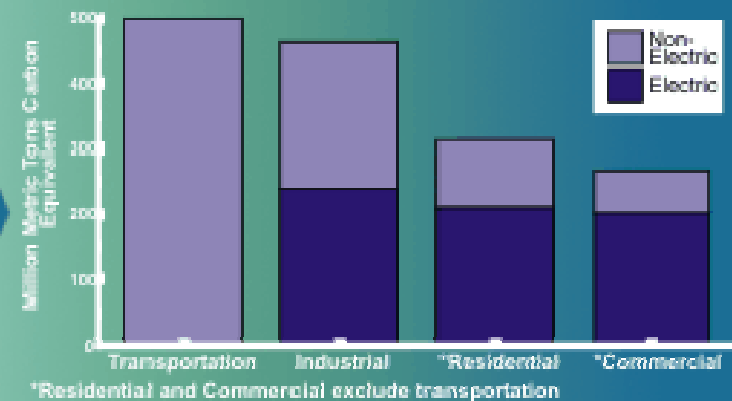
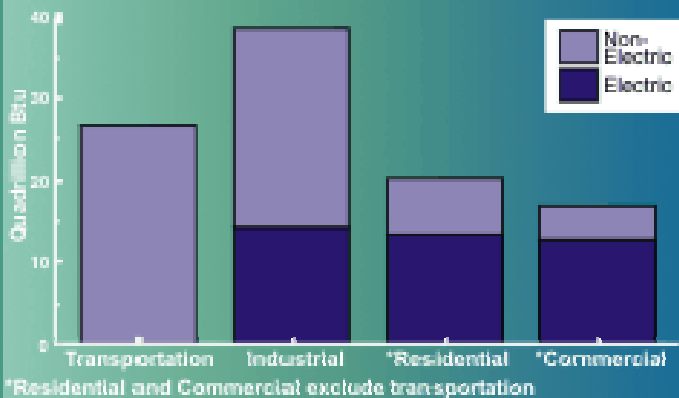
By Fuel Type



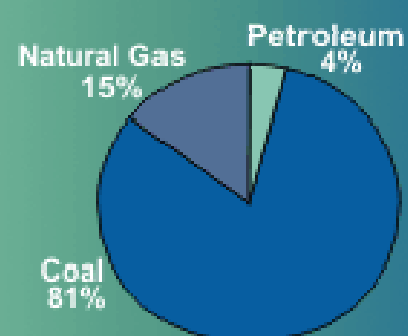
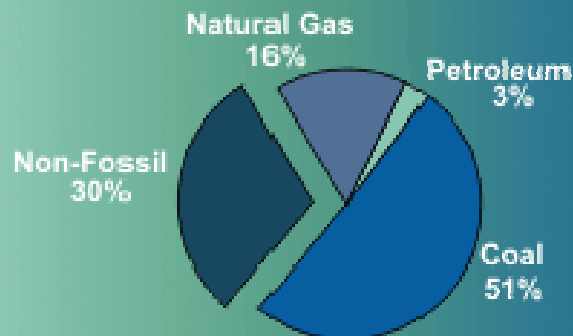
Resulting Carbon Dioxide Emissions



By End-Use Sector



By Electricity Sector



Source: Energy Information Administration

Needed GHG Emissions Reductions to Stabilize Atmospheric Concentrations at Current Levels

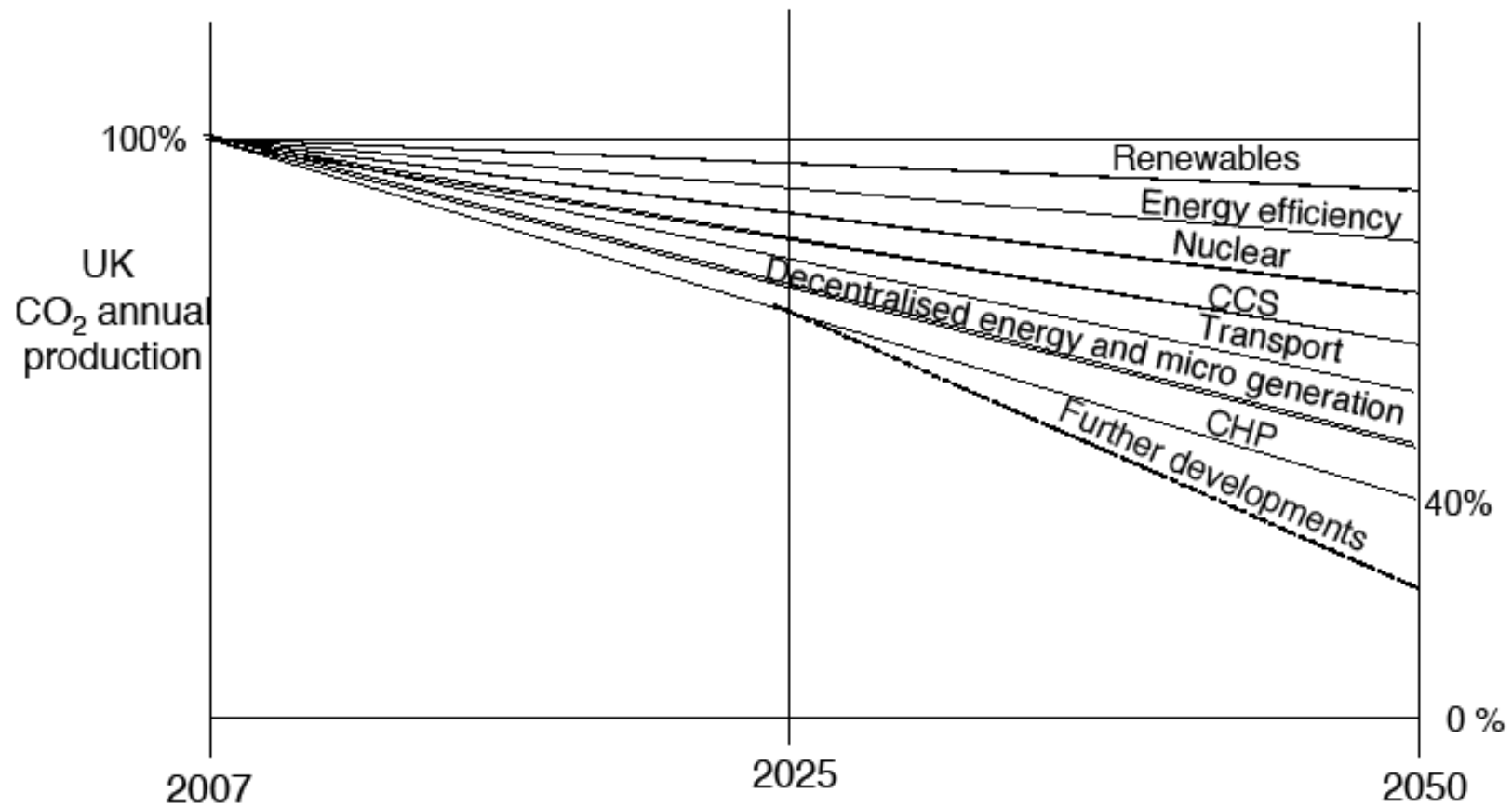
Carbon dioxide	> 60%
Methane	8 - 20%
Nitrous oxide	70 - 80%
CFC 11	70 - 75%
CFC 12	75 - 85%
HCFC 22	40 - 50%

Source: IPCC Second & Third Assessment Reports



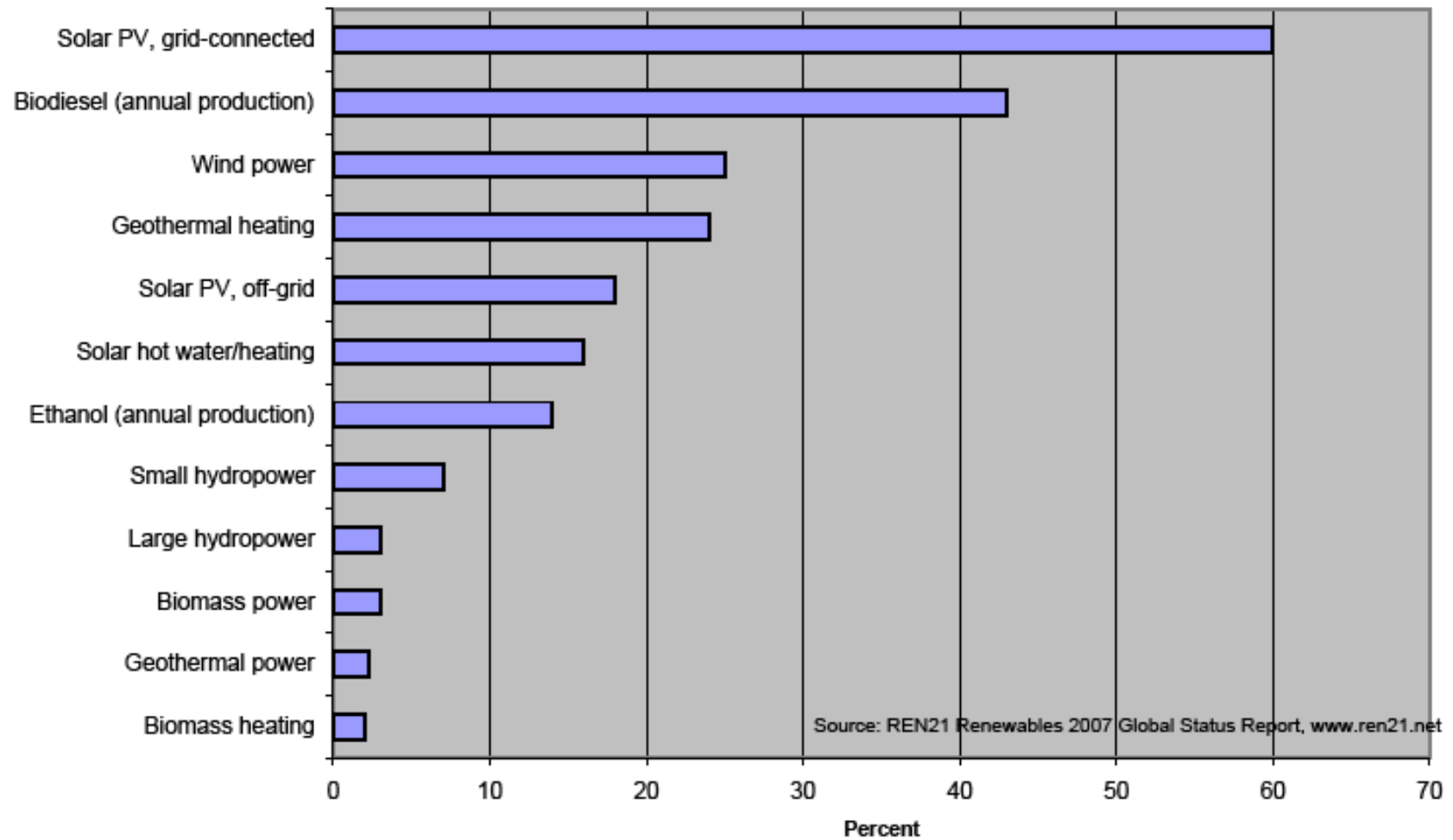
Center for Energy and Environmental Policy

The wedges solution to UK Emissions – illustrative



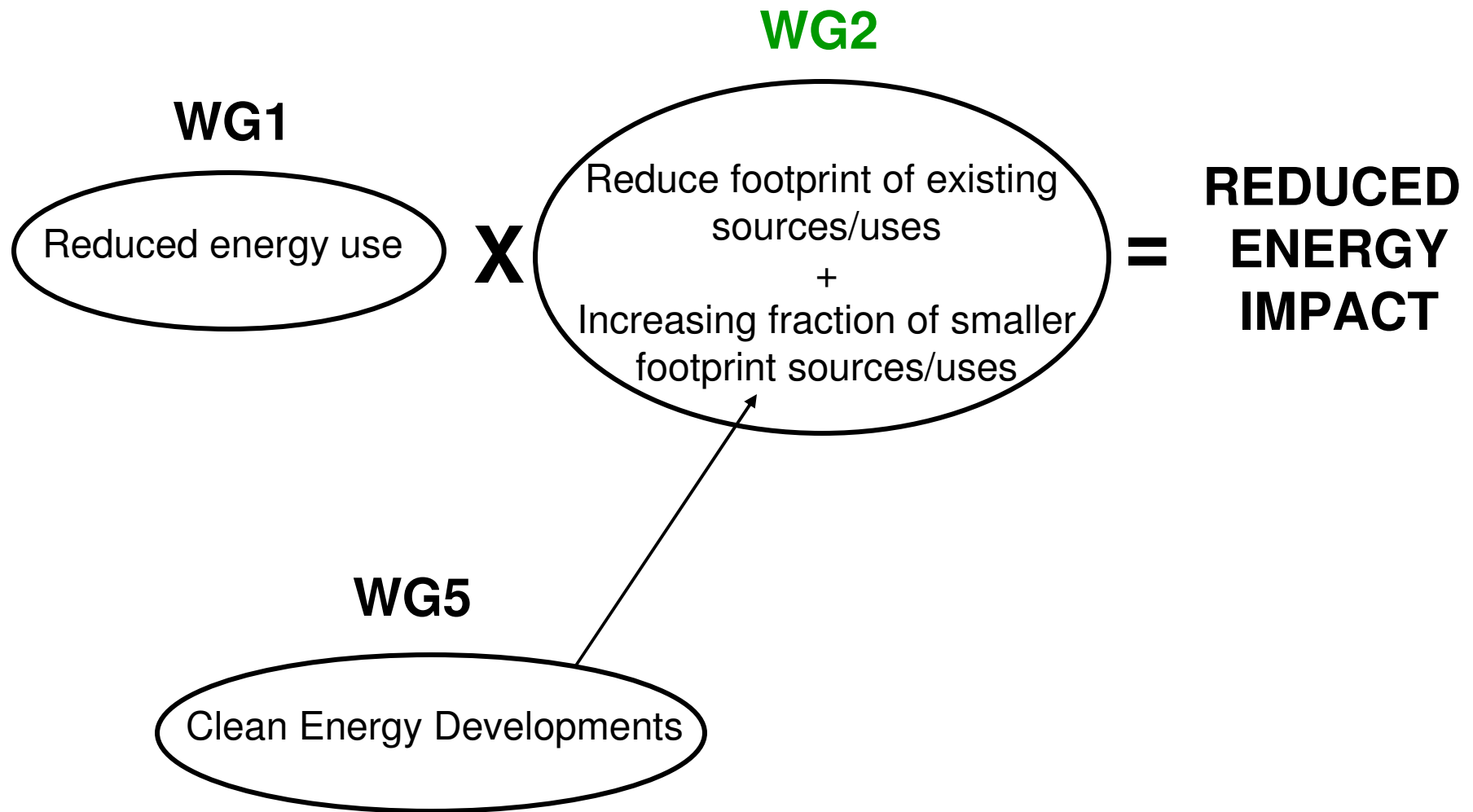
Sir David King, 2007 presentation to AAAS

Figure 3. Average Annual Growth Rates of Renewable Energy Capacity, 2002–2006



Next Energy Plan

- Reducing Delaware's Energy Usage
- Reducing Environmental Footprint of the Energy Delawareans Use
- Having Effective and Efficient Energy Transmission and Distribution Systems (for any type of energy or fuel)
- Reducing the Energy Impact of Transportation in Delaware
- Maximizing Delaware's Clean Energy Economic Development Opportunities



Delaware's Energy Footprint

Per capita energy use was ~357 million BTUs in 1999, and 372 million BTUs in 2005, a growth of 4.2% over the 6 year period. US average 2005 per capita energy use was 339 million BTUs; Delaware ranked as the 19th largest per capita user of energy. States with the lowest and highest 2005 per capita energy use were:

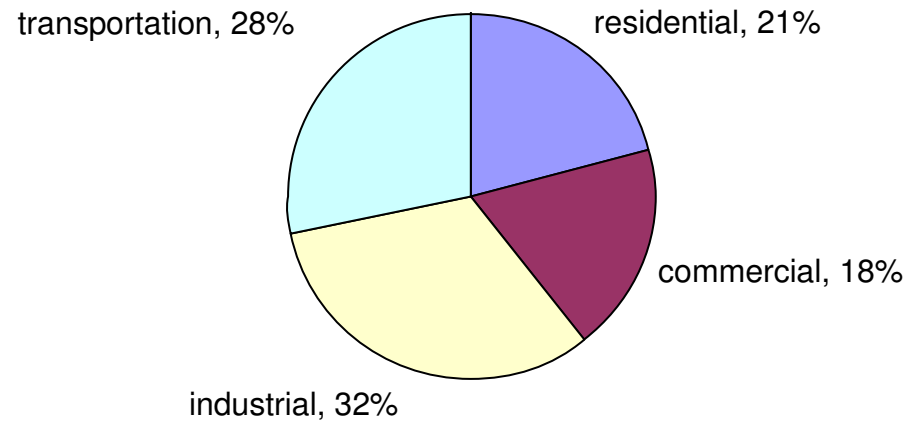
Rhode Island	213 million BTU
New York	217 million BTU
California	232 million BTU
Wyoming	912 million BTU
Alaska	1,192 million BTU

2005 per capita use was lower than Delaware in all neighboring states:

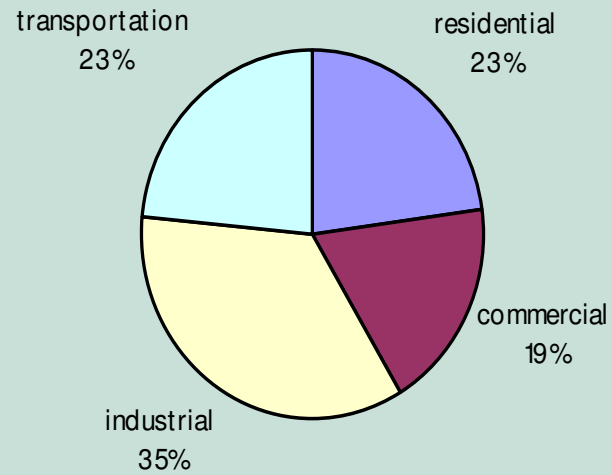
Delaware	372 million BTU
Maryland	279 million BTU
New Jersey	315 million BTU
Pennsylvania	327 million BTU

A note that should be made, Delaware's per capita figures are affected by refineries and power plants vs. the relatively small population.

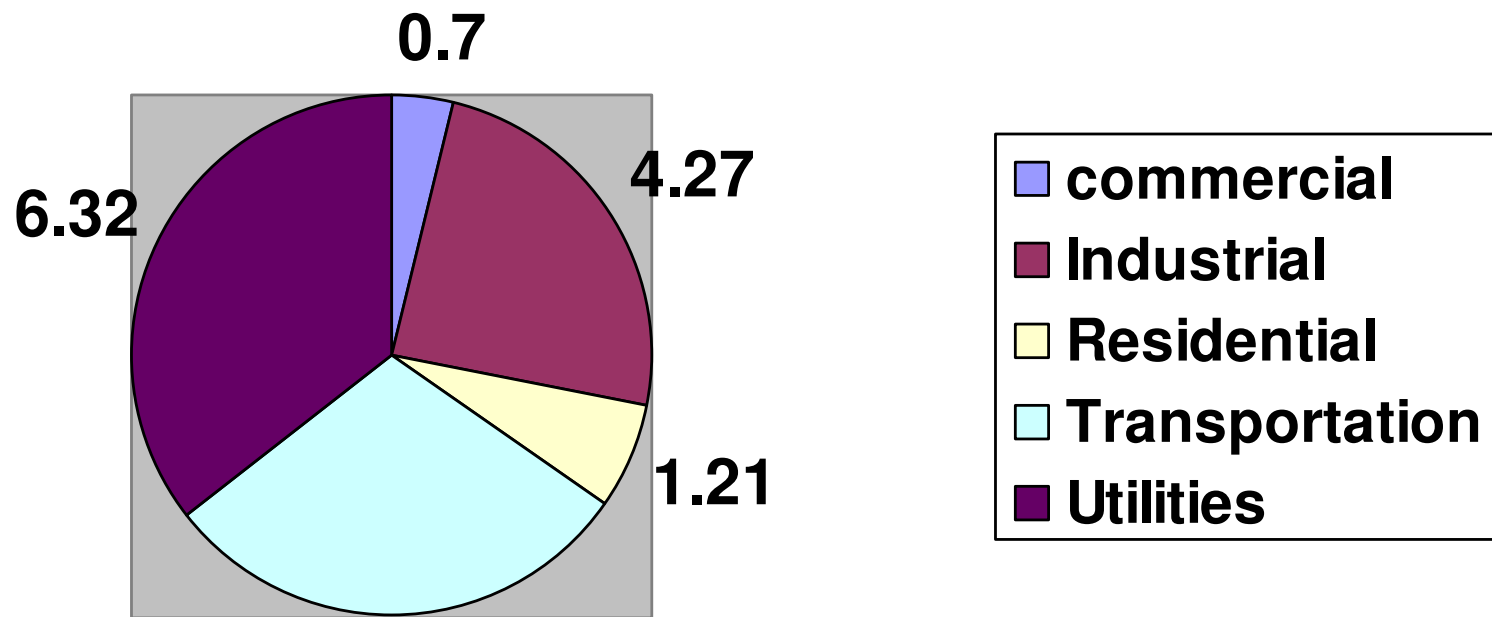
US Energy Use by Sector, 2006



Delaware Energy Use by Sector, 2005

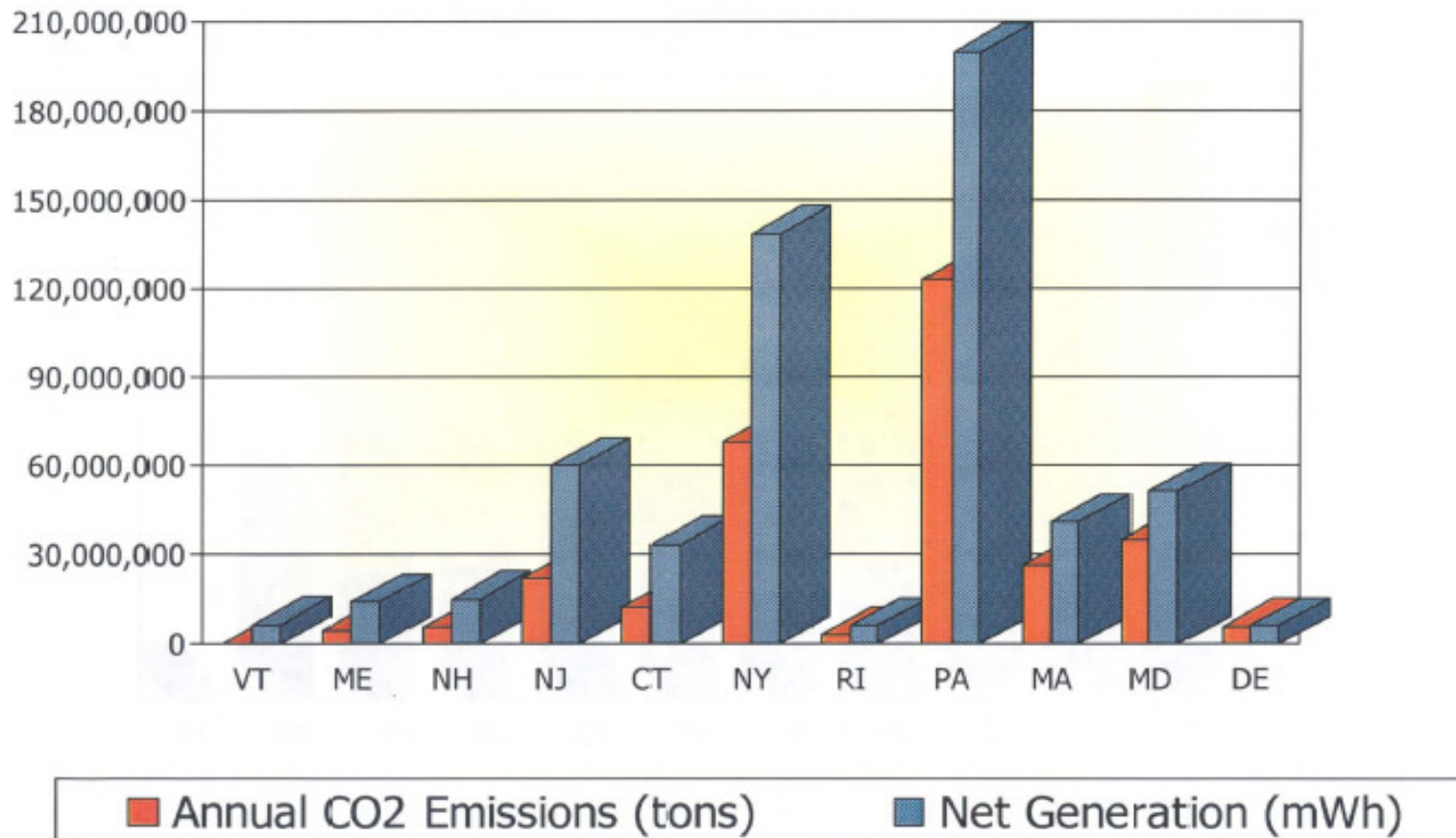


CO2 Emissions by Sector (million metric tons)

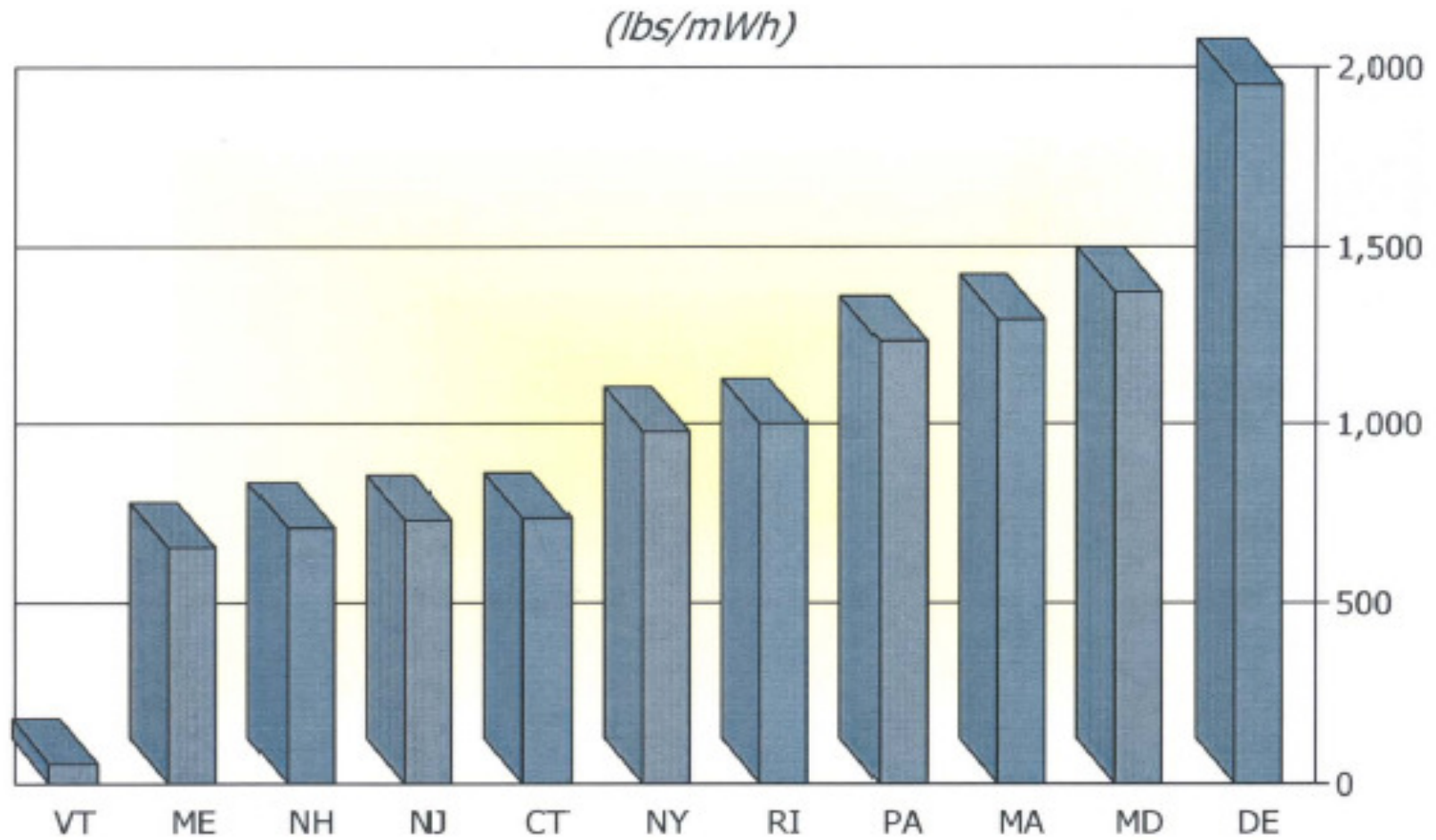


2005

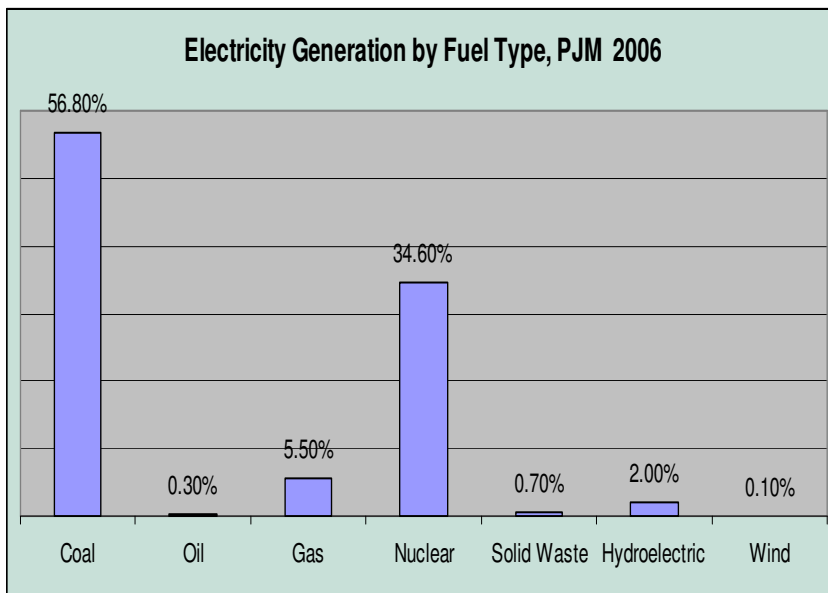
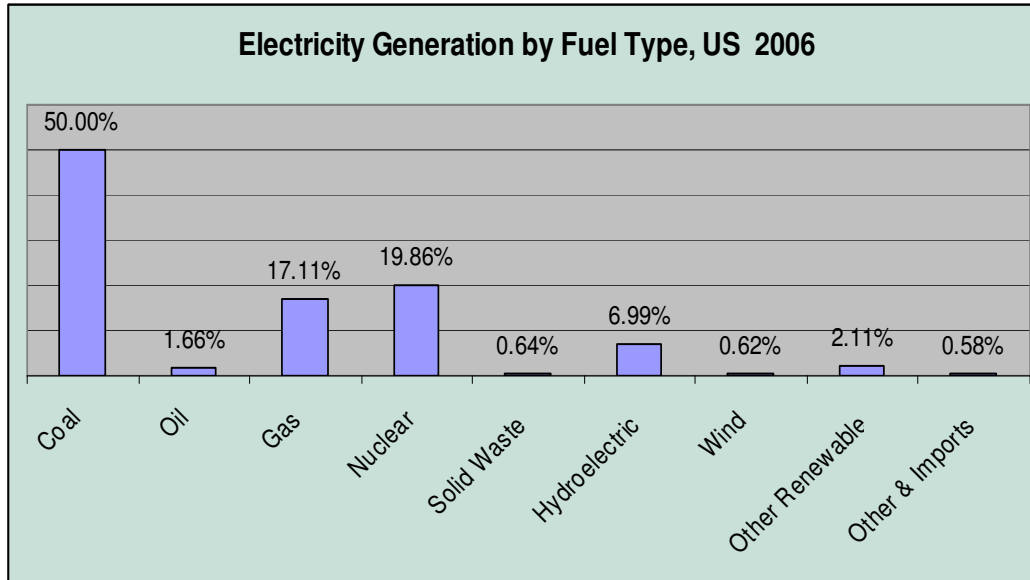
Year 2000 Generation and Emissions



CO₂ Output Emission Rate



Where Does Our Electricity Come From?

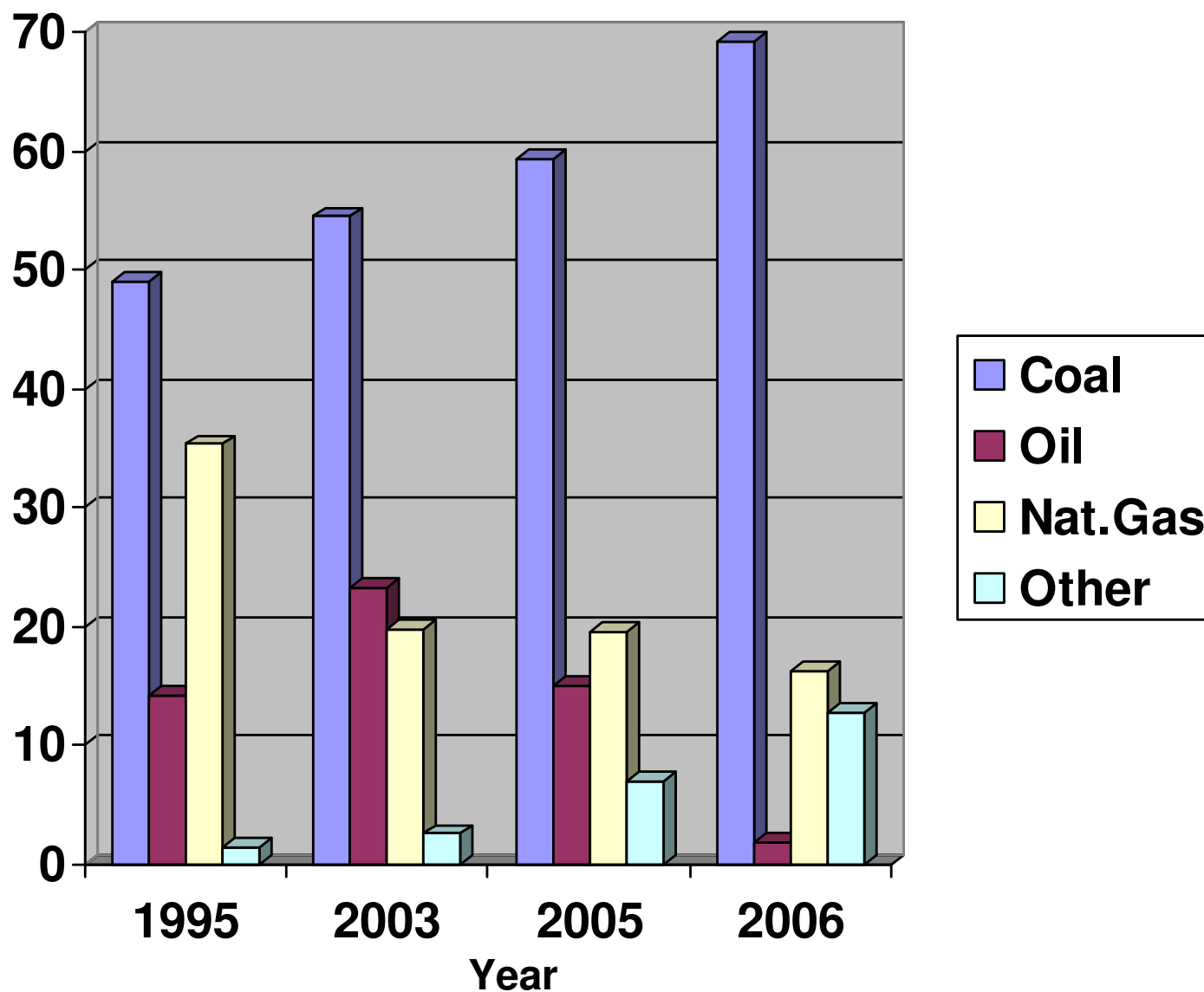


Generation and Consumption in Delaware (2006)

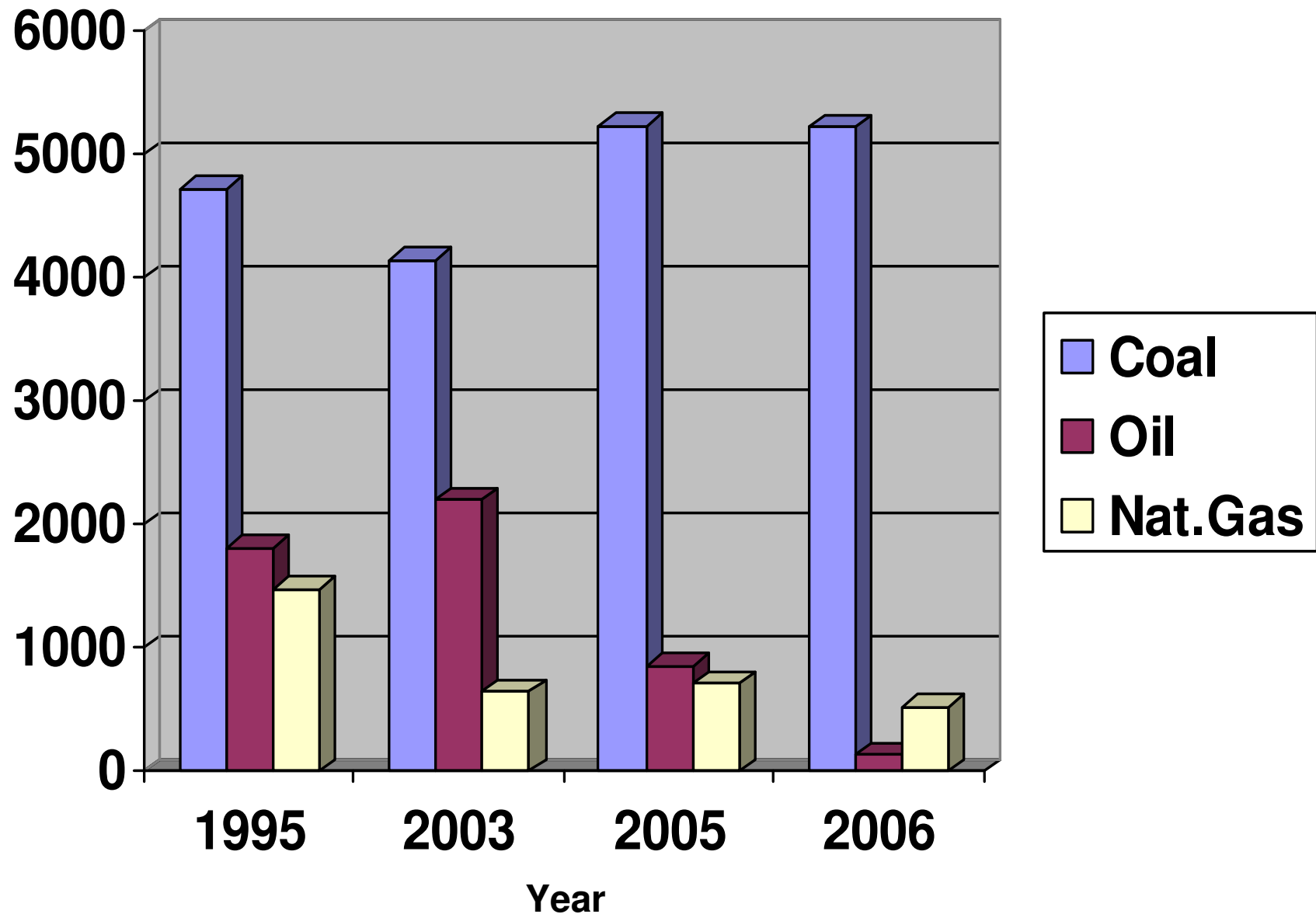
Delaware electricity consumption: 11,555 million kWh

Delaware electricity generation: 7,182 million kWh

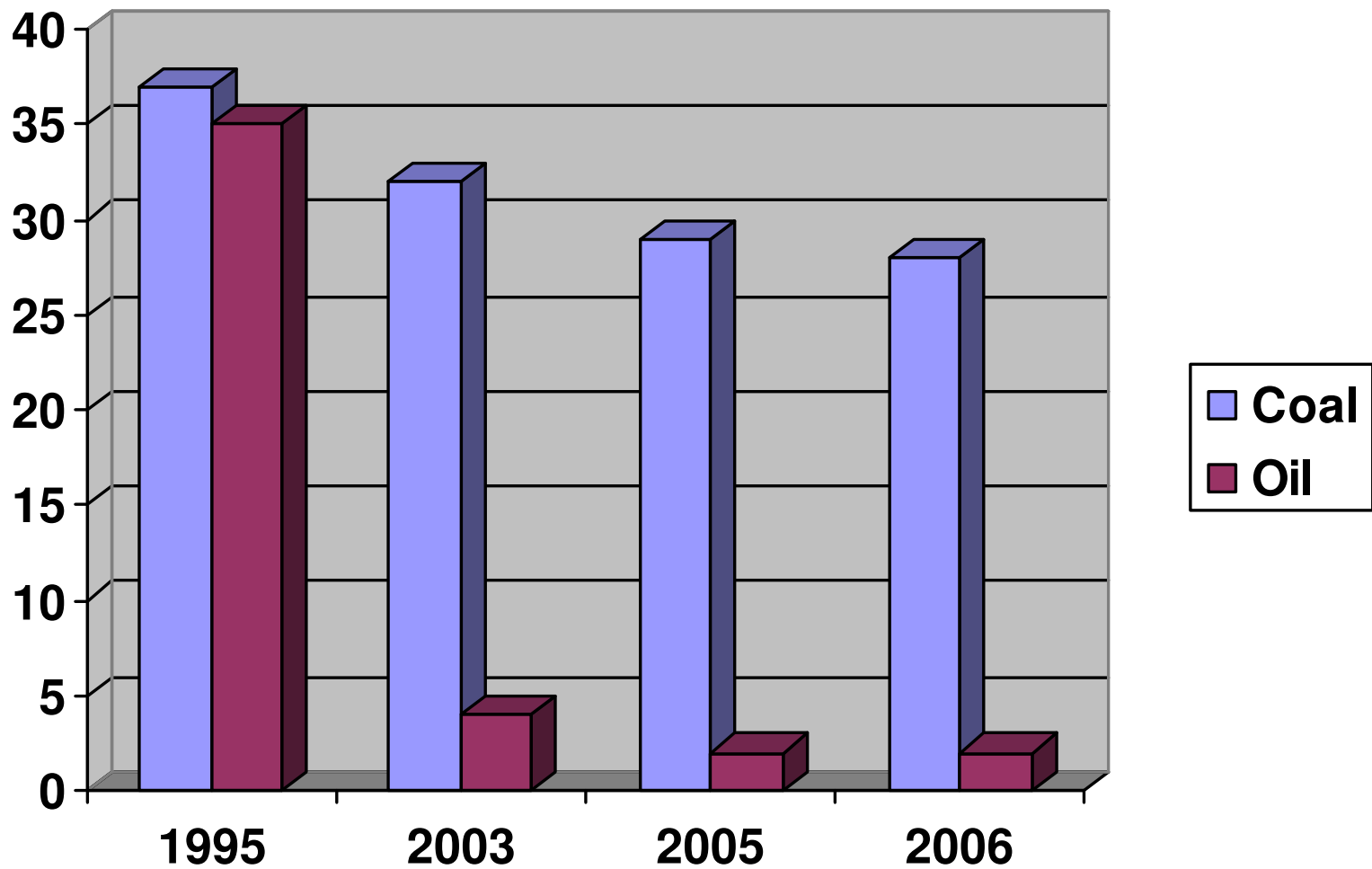
In-State Electricity Generation by Source Type (%)



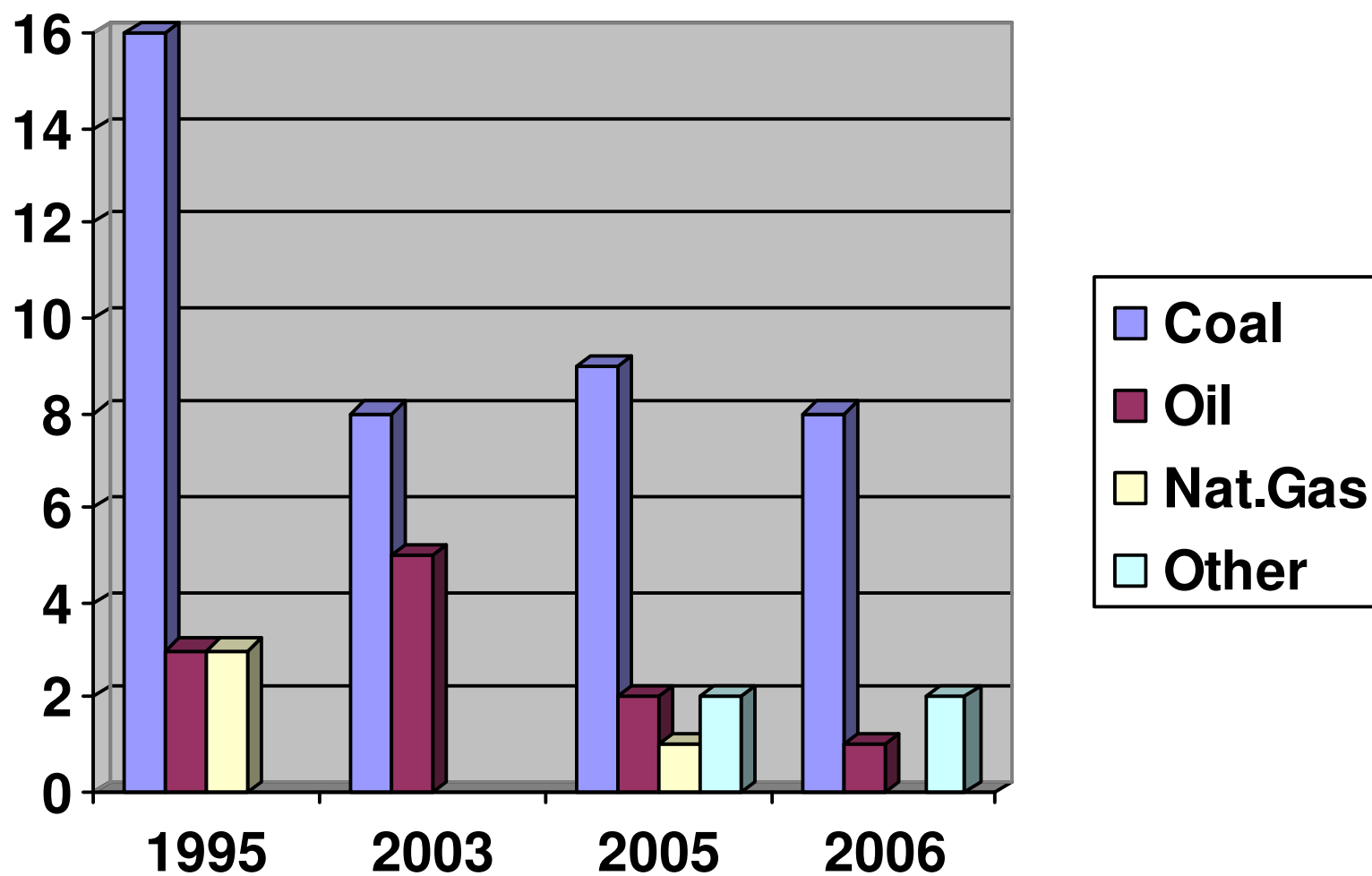
CO₂ Emissions from Electricity Generation in Delaware (thousand metric tons)



SO₂ from Delaware Electric Power Plant Emissions (Thousand Metric Tons)



NO_x from Delaware Electric Power Plant Emissions (Thousand Metric Tons)

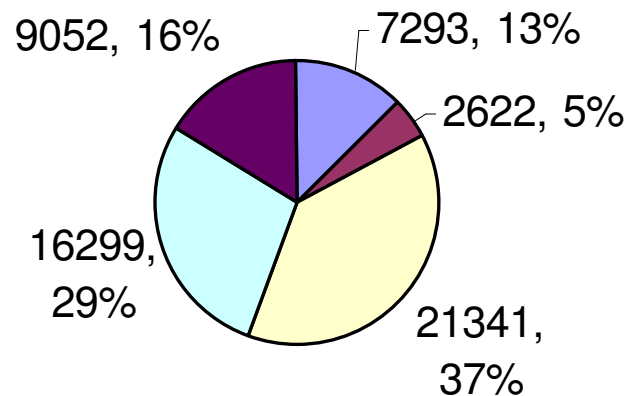


Plant Name	Main Fuel	Other Fuels	Nameplate Capacity (MW)
City of Dover			
McKee Run	Residual Oil	Natural Gas	151.2
Van Sant	Natural Gas	Distillate Oil	45.1
Conectiv			
Christiana	Distillate Oil		45
Delaware City	Distillate Oil		14
Edge Moor	Coal	LFG, WWTP Gas, Natural Gas, Distillate Oil	251.8
Edge Moor	Residual Oil	Natural Gas, Distillate Oil	446
Edge Moor	Distillate Oil		12.5
Hay Road	Natural Gas	Distillate Oil	705
Hay Road	Waste Heat		237
West Substation	Distillate Oil		14
Invista	Coal	Residual Oil, Natural Gas	30
NRG			
Energy Center Dover	Coal	Natural Gas	18
Energy Center Dover	Natural Gas	Distillate Oil	100
Indian River	Coal	Distillate Oil	782.4
Indian River	Distillate Oil		17
Premcor			
Refinery	Refinery Gas		119
Refinery	Refinery Gas	Syngas	63
Refinery	Syngas	Distillate Oil, Natural Gas	180
Warren F. Sam Beasley Station	Natural Gas	Distillate Oil	45

Plant Name	CO2 (TPY)	SO2 (TPY)	NOx (TPY)	PM2.5 (TPY)	VOC (TPY)
City of Dover McKee Run	19,959	55	47	3	1
City of Dover Van Sant	2,538	0	2	0	0
Conectiv Christiana	1,257	2	5	0	0
Conectiv Delaware City	724	1	2	0	0
Conectiv Edge Moor	1,657,418	7,982	1,665	416	24
Conectiv Hay Road	564,024	3	269	30	9
Conectiv West Substation	474	0	1	0	0
Invista	270,946	4,143	1053	249	3
NRG Energy Center Dover	127,498	1,531	382	95	2
NRG Indian River	3,573,125	20,706	6,373	2,346	33
Premcor Refinery	1,665,563	496	779	21	4
Warren F. Sam Beasley Station	9,360	0	2	1	0

Environmental Impacts from Energy - NO_x

NO_x - tons per year

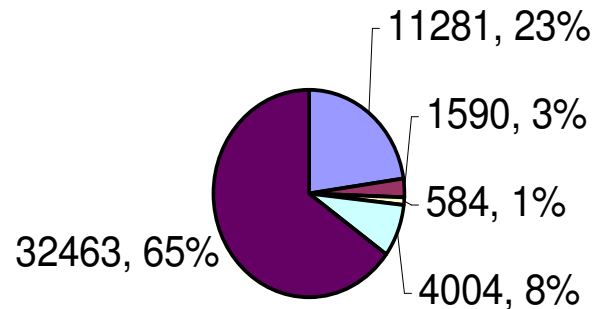


■ Point (less EGUs) ■ Area ■ On-road ■ Off-road ■ EGU's

- Over **47,000 tons per year** emitted in Delaware
- **Mobile sources account for 66%** of states NO_x
- Delaware's power plants accounted for about 16% of Delaware's overall NO_x inventory for 2002.

Environmental Impacts from Energy - SO₂

SO₂ - tons per year



■ Point (less EGU's) ■ Area ■ On-road ■ Off-road ■ EGU's

- Approximately **50,000 tons per year** emitted in Delaware
- Delaware's power plants (EGU's) account for 65% of the SO₂ emitted in the state (after the DCR project).
- 75% of the off-road SO₂ emissions are from commercial marine vessels.

Other Power Plant Issues

- Water use from DE coal plants estimated at 1.5 BGD – 2% consumptive
- Fisheries impact significant
 - Hundreds of millions of fish eggs and Larvae
 - Hundreds of thousands of fish
- Health implications
 - Asthma/respiratory ailments
 - Mercury impacts
 - Cancers
- Acid rain/deposition
- Aerial nitrogen deposition
- Ash disposal/landfills
- Particulates
- Smog/visibility issues
- **Carbon**

New Regulations/Strategies

- Renewable Portfolio Standards (RPS)
- Sustainable Energy Utility (SEU)
- Regional Greenhouse Gas Initiative (RGGI)

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Key Questions to be Addressed by the Work Group:

1. What policies and programs can be put into place that will reduce the environmental footprint of Delaware's energy use?
2. How should Delaware meet its current and future electricity requirements?
3. What will the impact be on Delaware's electricity generation system as the price of coal rises? The price of natural gas? The price of carbon?
4. What can be done to moderate price shocks or create price stability over time? What is the likelihood of price stability or instability?
5. What is the likelihood of future regulations impacting the energy type used to generate electricity in Delaware?
6. What should be the appropriate balance between regionally generated electricity and transmission from distant generation facilities?